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Statement by:

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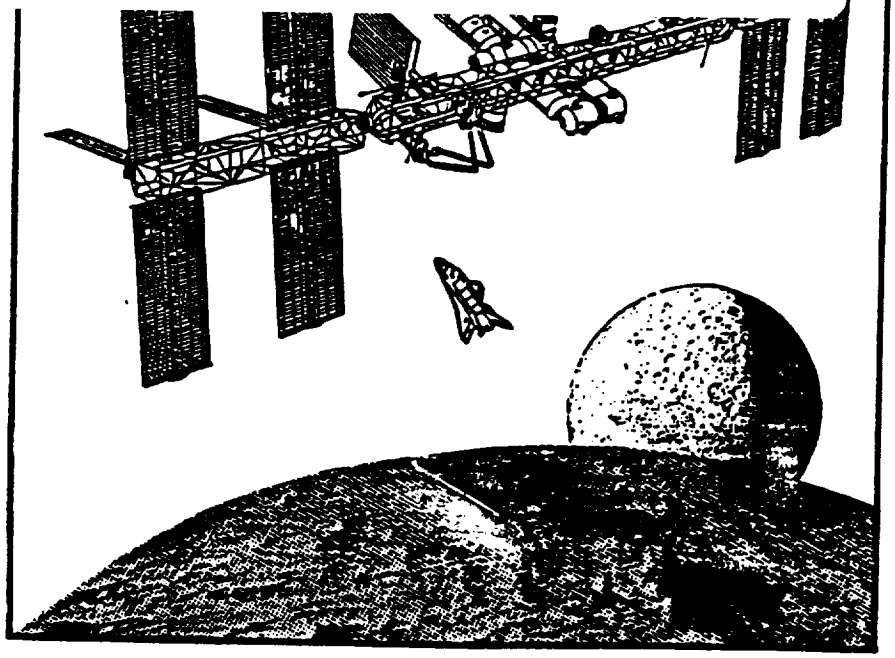

101st Congress

Mr. Chairman and Members of the Subcommittee,

I am pleased to be here today to discuss NASA's recent accomplishments on the Space Station Freedom Program -- they have been significant. I will describe these accomplishments in detail, as well as identify work now in progress. Finally, I will discuss NASA's budget request, focusing on the important activities for which these funds are required.

Let me begin, however, by emphasizing that the reasons why our nation is building Space Station Freedom are now more relevant than ever. Last year's successful return-to-flight of the Space Shuttle was an important step toward reinvigorating American leadership in space. With Space Station Freedom, safe and effective operation of the space shuttle, and programs such as the Great Observatories, we are ensuring that the United States maintains this leadership through the late 1990s and well into the next century.

A permanently manned base in orbit is vitally necessary for our nation to sustain this leadership and to continue reaping its associated wealth of benefits. The importance of this program has been repeatedly recognized in Presidential and Congressional decisions to proceed with Space Station Freedom and keep the program on track. President Bush reiterated this recently when he said, "We must have a manned space station... the space program should always go 'full throttle up.' That is not just our ambition; it is our destiny."

The benefits of our leadership in space and federal investments in space research and development have been very tangible - they have enhanced our national science and technology base and contributed to our economic well being. As an investment in the future, Space Station Freedom is no exception. I am convinced that people will play a productive role in space, just as they do on Earth. The capability to live and work in space laboratories and workshops on a continuous basis, 365 days a year, will result in significant benefits.

Space Station Freedom is the next step in the development of our national space infrastructure. Just as railroads played a central role in opening the American frontier for development after the initial exploration, this infrastructure will be the foundation to open the frontier of space for development.

As a cornerstone of this infrastructure, Space Station Freedom complements capabilities and objectives across all parts of our space program. For our science program, Freedom offers platforms for instruments to look out at the universe as well as back toward the Earth, and a laboratory for research in many scientific disciplines. Long term operation on the manned base or its associated platforms will be a natural growth path for scientific experiments developed on the ground and flown on the Space Shuttle or privately developed facilities. For technology development, Freedom will be a unique national facility - a testbed for evaluating technologies, procedures, and design approaches for potential application in future space systems. Technology benefits may even begin to flow before Freedom is operational in such important areas as control of large space structures, power generation, automation and robotics, and environmental control. For our exploration program, Freedom's manned base represents the establishment of a permanently manned outpost in space.

Freedom will initially be most valuable as a space workshop, laboratory, and viewing platform. As our leadership and vision continue and as national requirements are defined, it can evolve to accommodate other potential roles: a "construction facility" for assembling large space structures, a "service station" for satellite refueling and repair, and a "production facility" for unique materials and substances.

The long term goal of expanding human presence and activity beyond low earth orbit requires the space station for potential missions to the moon, Mars, or other parts of the solar system. Initially, we will use the manned base to study the long-term effects of the space environment on people to prepare us for the potential missions of the future. Before we take this step, we must understand the effects of weightlessness in humans, and develop countermeasures to prevent any detrimental effects. Freedom may one day be our waystation in orbit, a staging area for manned expeditions venturing out from our home planet to explore other parts of the solar system. No matter what major objectives we choose for the early 21st Century, Freedom is a necessary stepping stone. NASA's Office of Exploration succinctly captured the importance of this fact in a single phrase in its 1988 Annual Report: "All roads begin with Space Station Freedom..."

When our presence in space matures from short visits to prolonged stays, the inherent nature of research in space will change, facilitating not only the normal process of scientific investigation, but also the totally unexpected - and sometimes serendipitous - discoveries that have historically been so important to technological advancement. Moreover, the human innovative spirit will be unleashed from the constraints of limited time and experience in this new environment. Advances in space technology, materials science, life sciences, and biotechnology will probably be the first visible dividends we earn, but there will be many, many more.

The program will have a positive motivational influence on education. Freedom's high public visibility and our educational programs will revitalize interest by our young people in science and engineering careers. Furthermore, the capability to conduct rapid response experiments in reaction to new ideas and research opportunities will have a positive impact on university students and researchers, particularly those pursuing advanced degrees. All of these factors will act to strengthen our national technological competitiveness and long-term economic well-being.

At a higher level, Space Station Freedom will offer benefits that transcend the objectives of any single nation. Freedom will not only become a global focal point for space research, it will also help us better understand the world in which we live.

This role becomes increasingly important as world interest in global environmental changes grows more urgent. Space Station Freedom's capabilities will support the U.S. Global Change Research Program to examine closely the impact of environmental changes on our planet. Global problems such as deforestation, desertification, ozone depletion, and climatic shifts will be studied by instruments on both the manned base and its associated polar platforms.

When President Reagan called for the development of the space station, he invited international participation to strengthen peace, build prosperity, and expand freedom for all who share our goals. After three years of intensive negotiations, our partners (Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, and the United Kingdom) are providing major program elements estimated to cost nearly $8 billion, making Freedom an unparalleled effort in international science and technology cooperation. At the Intergovernmental Agreement signing ceremony last year, former Secretary of State George Schultz noted that "this project also will be a shining symbol of the commitment of those who place a high value on political and economic freedom to cooperate for mutual benefit."

President Bush, like President Reagan, recognizes that space holds enormous potential for commerce. He supports private sector investments in space with specific policy guidance and instructions. We are actively seeking private sector involvement in the program through two distinct avenues: commercial utilization of Space Station Freedom and commercial provision of program-related infrastructure. The innovative strengths of American industry can make a substantial contribution to our space activities. This will be covered in more detail later in the testimony.

We have already made significant progress toward achieving the objectives I have described thus far. A strong management structure, tailored to handle the complexity of the Freedom program, has been established. We have confirmed that our configuration is the correct one to meet our national objectives. Freedom's team of contractors, most of whom have worked on the program for four to six years, is now engaged in design activities. Last, the program is on schedule and projected costs remain unchanged.

It is essential that Space Station Freedom program activities continue to be fully funded if our early efforts to build a proper program framework are to result in substantial savings in the years ahead. Total life cycle cost factors are at least as important as development costs in design decisions. Similarly, we will continue to place a strong emphasis on ensuring that user needs are addressed during the design process. These early efforts, which will later enable us to achieve the maximum benefit from Space Station Freedom for the lowest reasonable cost, must continue unimpeded.

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Program Status: Recent Accomplishments and 1989 Activities

I would now like to move on to our recent progress and ongoing activities.

An effective development structure for the Freedom program is now in place. Last September, NASA signed contracts with the four work package prime contractors. Boeing is working with the Marshall Space Flight Center to develop the U.S. pressurized modules and logistics elements. McDonnell Douglas is working with the Johnson Space Center to develop the central truss structure, resource nodes, and various flight systems. General Electric is working with the Goddard Space Flight Center to develop the Polar Platform and attached payload accommodations on the manned base. Rocketdyne is working with the Lewis Research Center to develop elements for power generation, storage, and distribution.

To enable the long-term intersite delivery process and to reduce program risk, Associate Contractor Agreements have been instituted among these companies. These agreements facilitate direct interaction in resolving detailed interface and scheduling problems before products are delivered. The resulting increase in efficiency will minimize costs, reduce program risks, and allow better use of resources.

We also have in place three contracts that are important components of the development structure required to successfully address the complex management and technical issues of the program. These efforts, managed by the Space Station Freedom Program Office in Reston, are just as essential to the success of the program as the development contracts.

The Program Support Contractor, Grumman, performs critical systems engineering and integration tasks for the program office. This contractor also plays key roles in supporting program management processes, in laying groundwork for operation planning, and in interactions with the user community.

Lockheed is developing the Software Support Environment, an integrated set of standardized software "rules and tools" that will simplify the development, operation, and maintenance of computer programs used in both flight and ground systems over the life of the Freedom program.

Finally, Boeing is developing the Technical and Management Information System. This system and associated services will provide a conduit and storage resource for the virtual flood of information that will flow among hundreds of organizations during Freedom's development and 30-year life.

An intensive review by the National Research Council in 1987 confirmed that our baseline configuration is the best design suited to meet the overall requirements. The report stated that the configuration "reflects the thoughtful compromises among the priorities and sometimes conflicting requirements of its early scientific and engineering users." Last year we formally defined space station system and element requirements so that preliminary design activities could begin. A program-wide requirements review, held in the early summer, was followed by more detailed requirements reviews at the NASA Centers responsible for the four work packages. The objective of these efforts was to ensure that critical design requirements throughout the program were identified, quantified, and reflected consistently in documentation at all program levels.

With these important milestones behind us, our development efforts are now underway. The four NASA work package centers and their prime contractors are now heavily involved in design activities for their assigned Space Station Freedom elements and systems.

Our advanced development program for some critical hardware is beginning to show some return, and we are seeing tangible results. Prototypes of the rotary joints that will point the solar arrays and thermal radiators have been fabricated by Honeywell and delivered to Johnson Space Center for testing. A prototype of the control moment gyroscope needed for attitude control was built by Allied-Signal and will shortly undergo life testing at Johnson Space Center to verify the design and evaluate new features. Substantial work has been performed by Marshall Space Flight Center and its contractors on the environmental control and life support system. Selected elements of this system have been built, several new technologies for waste management have been developed, and tests are now in progress to measure their effectiveness in an environment similar to that planned on Freedom. In the area of automation technology, Goddard Space Flight Center is continuing its work on advanced robotic manipulators. At the Lewis Research Center, nickel-hydrogen batteries are undergoing life cycle tests to provide data needed for their use on Freedom. Testbeds to demonstrate the operation of a 20KHz power management and distribution system have been built. Hydrogen/oxygen thrusters and resistojet thrusters are also being tested.

Utilization and operations planning is an extremely important ongoing process in the design of the station because it ensures that user requirements are properly incorporated and that the manned base and polar platforms can be effectively operated over the long term. Working together with the user community and our partners, we are defining the detailed requirements for a wide variety of user activities. Workshops were held last year to exchange information on science operations, user accommodations, ground processing and related topics. On-orbit operations and maintenance concepts are being defined to influence system design. Additionally, long term logistics support has been incorporated as a major driver in system design and acquisition decisions.

Two important facilities for Space Station Freedom were recently completed to support ongoing hardware development efforts. The Space Station Mockup and Integration Facility at Johnson Space Center was dedicated in November. The Power Systems Facility at Lewis Research Center was dedicated this January.

In September, the U.S. Secretary of State and representatives of Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, and the United Kingdom signed the Intergovernmental Agreement covering cooperation in the Space Station Freedom Program. This monumental agreement will be the foundation for three decades of international space station activities. Robert de Cotret, who signed the agreement on behalf of Canada, aptly stated, "today is the fusion of two modern trends as one, when several nations agree to work together in the peaceful exploration of the universe that surrounds our globe. In doing so, we make for a better world here on Earth."

NASA also signed separate bilateral Memoranda of Understanding with the European Space Agency and the Canadian Ministry of State for Science and Technology that focus on programmatic and technical aspects. We will sign a similar agreement with Japan this spring. These agreements, coupled with the strong budget commitments of our international partners, represent long term commitments to the success of this program.

With the negotiations behind us, we have moved to the implementation phase of the cooperation. We are working with our partners to establish the management mechanisms created in the Intergovernmental Agreement and the Memoranda of Understanding. We are also developing the second-tier documentation called for in our agreements. Our partners have established liaison offices here in the United States, and we are completing the establishment of similar offices in our partners' countries. These liaison offices are critical to working with our partners effectively and efficiently.

Earlier this month, NASA announced the selection of scientific investigations for definition in the Earth Observing System program. This effort to study global environmental changes will utilize instruments on polar orbiting platforms, beginning with the Space Station Freedom Polar Platform. The selected teams' activities will involve 551 investigators from 168 institutions, universities, and laboratories in 32 states and 13 nations.

To encourage and promote commercial participation in Space Station Freedom infrastructure, we released draft policy guidelines, procedures, and criteria for industry review last October. This document will be revised and formally issued after industry comments are received this year. Additionally, in 1989 we plan to establish a process for identifying future space station requirements that could be commercially provided, along with implementation mechanisms consistent with Administration policy and procurement regulations .

In November, we co-sponsored with the Office of Commercial Programs our second successful workshop on commercial opportunities in the Space Station Freedom Program. Potential opportunities in materials sciences, remote sensing, life sciences, and infrastructure were discussed with 150 industry representatives. This workshop will be held annually.

We are still on schedule for the major program milestones, including the first element launch in the first quarter of 1995, man-tended capability in the fourth quarter of 1995, permanently manned capability in the fourth quarter of 1996, and assembly complete in the first quarter of 1998. These dates are the same as those presented to you last year.

Finally, I want to note that our estimate of total runout costs for the Freedom development effort remains at $13 billion in 1984 dollars. In summary, the program has stabilized. The configuration has been set since 1987, and our cost estimates and schedule remain the same.

We have been able to maintain our schedule and cost plans only because Congress and the Administration have strongly supported the build-up in funding levels that is essential to a program of this scope. You demonstrated this support last year when you approved a three year authorization for the Freedom program. Your continued support is absolutely imperative if Space Station Freedom is to be built cost-effectively and on time.

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Budget Request For Fiscal Year 1990

The funding required for Space Station Freedom in FY 1990 represents a substantial increase over this year's funding. This increase is necessary if we are to design and build the right station, on schedule and at the overall funding level we have set. To support the design process that is now

underway for most Freedom elements and components, our contractors' engineering work force must be expanded considerably, and subcontractors must be brought on board as planned. In addition, ground facilities required for testing, training and integration must be completed in order to support the schedule. Total aerospace-related jobs associated with the Space Station Freedom Program are estimated to increase from 15,000 to 32,000 across the country.

$2.050 billion is required to keep the Space Station Freedom Program moving forward in FY 1990.

Of this total, $1.556 billion will go to the four work package centers in order to pay for the required buildup of development activities at the four prime hardware contractors and their subcontractors. The NASA centers will continue to use their expertise and facilities for supporting development activities such as test bed construction and operation, in-line hardware development and supporting analyses, safety reviews, and quality assurance.

$184 million will go toward operations and utilization capability development. This effort includes the design and development of equipment, facilities, and capabilities required to operate and use Space Station Freedom efficiently and effectively.

$230 million will be spent to integrate the program's management and technical systems, to perform systems engineering, to coordinate activities with our international partners, to implement a software environment directed at controlling software costs, and to enable other program control and support activities.

$15 million will be spent on the Flight Telerobotic Servicer (FTS). Consistent with Administration policy, NASA is exploring private investment in development of the actual flight hardware, so the funds we request at this time are only for activities at the Goddard Space Flight Center that support development.

$25 million will be required for the Transition Definition Program to ensure that Space Station Freedom is designed to easily incorporate new capabilities to enhance utility, improve efficiency of on-board operations, support commercialization efforts, and meet future national objectives.

$25 million will be needed for Operations. Although some planning for operations is ongoing within the development program to ensure that user requirements are adequately addressed in the space station design, FY 1990 is the first year that funding is required to plan for integrated logistics operations and space systems operations in the program's actual operations budget.

Finally, $15 million is required for a new item in the program, a radar system to detect and monitor orbital debris. This effort, funded by NASA's Office of Space Flight prior to FY 1990, will provide data needed to ensure that the Freedom manned base will be adequately protected from debris impact.

In addition to the funding I have just discussed, the Administration proposes legislation for a three year advance authorization and appropriation of $8.5 billion covering FY 1990, 1991, and 1992. A program development cost ceiling of $13 billion in 1984 dollars is also proposed. This legislation would, by increasing programmatic stability and continuity of funding, facilitate resource planning and improve the cost-effectiveness of the development process.

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Activities Supported By FY 1990 Funding

Let me now move into the specifics of what we must accomplish in FY 1990 to maintain our goal of launching the first elements of Freedom in the first quarter of 1995. I will first describe development and supporting development activities for the four work packages, then move on to other work planned for FY 1990.

Work Package 1

Marshall Space Flight Center and its prime contractor, Boeing, will complete preliminary design of Work Package 1 elements and systems. These include the U.S. laboratory module, the habitat module, logistics elements, the environmental control and life support system (ECLSS), the resource node structure, and internal components of the audio/video and thermal control systems. Preliminary design reviews on these items will be conducted to allow final design activities to get underway.

Boeing will also complete comparative testing of ECLSS technology demonstration hardware and will begin testing in the Core Module Integration Facility, a full-scale mockup of the U.S. laboratory module. Work on resource nodes and airlock systems will focus on component testing of support equipment, preliminary design of the cupola, tool and production planning, and material procurement for structural test articles. Boeing will complete the U.S. laboratory engineering development article, and fabrication and test of development hardware and software will begin. Preliminary design of functions unique to the habitation modules will continue, as will the review of cargo requirements for the logistics modules. Concepts will be developed for the accommodation of specimens, carriers, and subsystems. Development testing for logistics-unique hardware and definition of logistics module interfaces with the cargo, Orbiter, and space station will continue. Neutral buoyancy facility tests will be performed to evaluate and verify man-systems interfaces. The critical design review on the node structural test article will be conducted, leading to the start of fabrication.

Marshall Space Flight Center will continue its supporting development efforts. Breadboards (hardware assemblies of preliminary parts used to prove hardware feasibility) will be used for development testing for the process-material management system, the audio-video system, and the electrical system. By the end of FY 1990, most of the supporting development testing will be completed and the prime contractor can begin building flight-design hardware for qualification testing.

Work Package 2

Johnson Space Center and its prime contractor, McDonnell Douglas, will complete preliminary design of Work Package 2 elements and systems. These include the central truss structure, mobile transporter, propulsion system, outfitting of resource nodes, airlocks, guidance, navigation and control system, external components of the thermal control system, communication and tracking system, data management system, and systems for extravehicular activity. Preliminary design reviews on these items will be conducted to allow final design activities to get underway.

McDonnell Douglas will also continue development testing and begin procurement, fabrication, and assembly of data management system hardware and software, the thermal control system, the mobile transporter, and the airlocks. Development of the propulsion system electrolysis unit, propellant tanks, and thrusters will be initiated.

Johnson Space Center will continue its supporting development efforts. Integrated loads/dynamics analysis of the Freedom truss structure will begin, a thermal vacuum chamber will be outfitted for solar simulation, and verification testing of the TDRSS on-board antenna will be conducted.

Fabrication and test of the propulsion system water electrolysis prototype will continue, and refinement and testing of an advanced space suit will be completed. Tests requiring a zero-gravity environment will be carried out on the KC135 aircraft, which can provide short periods of low gravity test time.

Work Package 3

Goddard Space Flight Center and its prime contractor, General Electric, will complete preliminary design of Work Package 3 elements and systems. These include the U.S. Polar Platform and attached payload accommodations, including a payload pointing system. Preliminary design reviews will be conducted to allow final design activities to get underway.

General Electric will also continue studies of servicing facility architecture, and will develop servicing scenarios for selected payloads located outside the pressurized modules.

Goddard Space Flight Center will continue its supporting development activities. The effects of space station motion on the payload pointing system will be studied. As part of the attached payload and polar platform thermal control program, development of a data management system test bed and an instrument test bed will continue, as will design of several experiments planned for flight on the Space Shuttle. Requirements definition and design of the planned Integration, Test and Verification Facility will be initiated. This facility will provide a clean environment for the check-out of attached payloads and the polar platform with the appropriate physical, electrical and thermal interfaces.

Work Package 4

Lewis Research Center and its prime contractor, Rocketdyne, will complete preliminary design of Work Package 4 elements and systems. These include power modules and other parts of the electrical power system. Preliminary design reviews will be conducted to allow final design activities to get underway.

Rocketdyne will also continue development and qualification of photovoltaic cells and substrate blankets. Qualification nickel-hydrogen energy storage assembly cells will be fabricated and tested. The preliminary design effort for the solar dynamic power system will continue. Development and testing of the 25 kW, 20kHz primary distribution breadboard and brassboard will continue.

Lewis Research Center will continue its supporting development efforts. Prime contractor systems engineering and integration efforts will be independently verified. Work on the photovoltaic power generation and storage and power management and distribution elements will continue, using several existing testbeds, and an integrated testbed will be built. Activities to support the solar dynamic power development effort will include thermal-vacuum testing of an advanced development heat receiver and optical testing of a solar concentrator.

In addition to the activities I have just described, each work package will be involved in many other significant activities. Continuous update of interface control documents will be crucial as system and system component designs mature. Each work package will also support development of the distributed systems that interface across more than one work package. Procurement of long lead items will also begin.

Operations / Utilization Capability Development

This effort spans activities at several NASA centers. The Program Office will continue to develop the tactical planning capabilities required for integrated operations and utilization activity planning during the assembly and operations phases.

The Kennedy Space Center will continue to develop capabilities for pre-launch and post-landing ground operations. Equipment for computer-aided design and computer-aided engineering will be procured, design of the Test, Control, and Monitor System will continue, and equipment for the Space Station Processing Facility will be procured. Marshall Space Flight Center will continue developing user integration capabilities. Design of the Payload Operations Integration Center and the Payload Operations Training Facility will continue, and analytical integration software tools will be developed. Johnson Space Center will continue to develop capabilities for operational control of Space Station Freedom. Design of the Space Station Control Center and the Space Station Training Facility will continue. Goddard Space Flight Center will continue user accommodation studies.

Each of the NASA Space Station Freedom development centers will also continue design of an Engineering Support Center to provide technical expertise during the assembly and operational phases of the program.

Systems Engineering, Integration, and Management

A program-wide preliminary design review will be conducted in the summer of 1990. In preparation for this review, the Program Support Contractor, Grumman, will conduct numerous integrated systems analyses to support the establishment of detailed design requirements for the work package contractors and the evaluation of end-to-end performance of their designs when integrated together into the space station.

Specific analytical efforts will include combined loads analyses, combined thermal system loading and performance studies, and assessments of the natural and induced particulate and electromagnetic environments around Space Station Freedom. The performance and interaction of designs for all distributed systems will be analyzed for each of the twenty on-orbit assembly sequence configurations as well as for contingency situations.

The Program Support Contractor will also play a key role in the development of program plans for launch package integration, on-orbit assembly and checkout, mission planning and integration, system safety plans, and quality assurance plans.

Operations

As the Space Station Freedom Program matures, elements of the development program (including operations/utilization concept development) will transition into components of the operations program. This transition will begin in FY 1990. Initial planning for integrated logistics operations will focus on logistics management, maintenance planning, and early planning for initial spares. Space system operations activities will include the study and integration of assembly planning tasks.

Transition Definition

Because Space Station Freedom will have an operational lifetime of 30 years, which is unprecedented for a space system, it must be designed to adapt to support evolving user needs. Moreover, elements and systems must easily accommodate future technology advances to enhance

productivity, reliability, and safety as well as to avoid obsolescence. For this reason, evolution planning and advanced technology development have already begun.

Evolution planning has already resulted in better definition of the resource requirements and primary design features (software hooks and hardware scars) required to accommodate evolution in the baseline design. In FY 1989, we are focusing on probable evolution paths and their impact on detailed hooks and scars in distributed systems. In FY 1990, we will begin feasibility studies on a reference configuration, and will identify the technologies necessary for evolution. We will also fund development work on the application of knowledge-based system technology to management of the distributed systems on the station. Other tasks will focus on automation technologies that could be applied to Space Station Freedom early in its operational lifetime. We will also continue to expand the efforts in planning for commercial participation in the space station.

Orbital Debris Radar

The development of the orbital debris radar will begin in FY 1990. This ground-based radar is required to gather new data on the orbital debris environment in which Space Station Freedom will operate. Since orbital debris is a potential threat to all space systems, accurate characterization of this environment is a necessary input to the design of the pressurized modules. The orbital debris radar, unlike existing radars, will be able to track debris between one and ten centimeters in diameter. The Jet Propulsion Laboratory will manage the development of the required hardware and software, which will be developed under a competitive contract.

Flight Telerobotic Servicer

NASA is currently reviewing proposals from two companies, Martin Marietta and Grumman, for development of the FTS. Contract award is planned for June 1989. The FY1990 budget for FTS assumes that NASA will seek private sector investment in system development. However, NASA will continue its supporting development and integration activities.

Contractor activities in FY 1990 will focus on two near-term test flights planned for the Shuttle. Detailed design of equipment for the early telerobotics demonstration test flight will be conducted, and preliminary design activities for the early development test flight and the Space Station Freedom flight article will begin.

Goddard Space Flight Center and other NASA centers will continue their supporting development activities. Applicable new automation and robotics technologies will be selected to improve FTS performance.

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I would now like to address two other issues associated with the FY 1990 budget request.

Commercialization

The NASA commercialization initiatives proposed by the Administration support national space policy and commercial space initiatives. President Bush reinforced the U.S. policy objective of more commercial development in space in his State of the Union message on February 9.

The specific commercialization initiatives for the Space Station Freedom Program include the FTS, the Space Station Processing Facility (SSPF), the Neutral Buoyancy Laboratory (NBL), the docking module, the logistics system, and potential enhancements like solar dynamic power.

The SSPF at Kennedy Space Center will be used for preflight processing of manned base hardware and both preflight and postflight processing of logistics elements. The SSPF was selected because of its potential for synergy with commercial proposals being considered by NASA in the area of logistics services. The private sector has already shown interest.

The NBL at Johnson Space Center will include a very large underwater working area for developing and practicing manned assembly approaches for Space Station Freedom. Existing facilities are too small to support the extensive activities planned. The astronauts who will assemble and maintain the manned base require intensive terrestrial training and preparation to maximize the safety, efficiency, and effectiveness of operations in space. The NBL was selected for commercialization because of its potential for long-term use by space station users and for terrestrial applications. The private sector has already shown interest. Potential commercial applications include preparation for undersea construction and maintenance activities, including those involved with offshore oil drilling.

The space station docking module was selected because commercial entities have indicated interest in developing it or are developing similar systems.

We will continue to explore ways to commercialize elements of the logistics system. Private sector proposals to participate resulted from our inclusion of the commercialization concept in the space station requests for proposals. We will continue to review with the Administration any significant issues that may arise.

The solar dynamic power enhancement for the space station could allow domestic firms to receive payment for the provision of power in space and to protect their technology for future applications.

NASA has been working on the development of specific criteria, guidelines, policies, and procedures to facilitate and encourage commercialization. These have been recently released for industry comment. We certainly seek Congressional views as well.

It must be recognized, of course, that commercialization decisions should consider the nature of the project involved, the stage of procurement, the nature and scope of commercial proposals, and resulting benefits to the government. Consequently, we will need to maintain flexibility in developing approaches to commercialization.

It should be noted that foreign competitors are moving ahead in space commercialization. Foreign companies, often in cooperation with their governments, are making investments to obtain financial benefits in the future. In Japan, for example, it is widely predicted that its space industry will be as important to its national economy in the future as its electronics industry is today. We in the government should be encouraging American companies to invest in our economic future in space as well.

The Space Station Manpower Problem

NASA's FY 1990 budget includes Research and Program Management (R&PM) funds for salaries of additional civil servants for Space Station Freedom. As the efforts of the space station contractors expand, NASA direction and oversight must also grow to ensure that Research and Development (R&D) funds are spent wisely and efficiently. The additional personnel requested for FY 1990 are required if we are to continue the strong management role necessary for effective systems engineering and overall direction of this international program.

In FY 1989, the Administration approved an agency-wide, multi-year staffing augmentation plan that included 725 additional civil servants to support the program at Reston and the work package

centers. Our plan is to accommodate an initial increment of this augmentation in NASA's FY 1989 operating plan. NASA's FY 1990 R&PM request must be fully funded to adequately meet space station staffing needs.

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Conclusion

In closing, I want to leave you with four important thoughts.

First, Space Station Freedom will result in a broad spectrum of benefits to the United States. Freedom is not a mission in itself. Instead, it is a unique capability that will yield significant technological, scientific, economic, social, educational and foreign policy benefits. Freedom is a vital piece of the space infrastructure our nation needs to support science, technology development and exploration efforts. We will depend on this valuable resource for decades to come. *Our investment now will pay tremendous dividends later.*

Second, our leadership in space will not go unchallenged. The future will belong to those who prepare for it and are committed to it, and the long term space plans of other nations are ambitious. Our commitment to Space Station Freedom is a commitment to U.S. space leadership, As President Bush so aptly stated, *"our commitment to leadership in space is symbolic of the role we seek in the world".*

Third, our plans for Space Station Freedom are well-laid and our program is stable. The right management and development structure is in place. We have the right configuration given our objectives and funding constraints, and we have already made a significant national investment in its implementation. Our international partners are fully committed to their parts of the program. *We have made substantial progress and are well on our way.*

Last, cutting corners would be inefficient. Our budget for FY 1990 is just barely adequate. Underfunding Freedom at this critical phase of the program would reduce its performance, and thus its usefulness. At the same time, *it would increase program risk, and increase total long term costs.*

When we, as a nation, chose to proceed with Space Station Freedom, we made the right decision for the right reasons. We cannot back away from our commitment to this endeavor, for it is too important to our future as a space-faring nation. The American space program has proven over the past three decades to be among our wisest investments, inextricably linked not only to the economic welfare and vitality of our country, but also to the nurturing of our national spirit. We have an unavoidable responsibility to look to the future and its challenges, and Space Station Freedom is an essential part of the American future.

We must stay on track.